In the Drawings

A replacement set of drawings is submitted herewith.

REMARKS

Entry of this Amendment in the above-identified application which is filed concurrently with the Request for Continued Examination is respectfully requested.

In the "final" Office Action dated May 12, 2010, the disclosure and drawings are objected to. Claim 54 is rejected under 35 USC § 112, second paragraph. Claims 52-57 are rejected under 35 USC § 103(a).

However, in view of the amendments to the specification, the claims and the submission of a replacement set of drawings, and for the following reasons, it is respectfully submitted that all grounds of rejection and objection have been overcome. Reconsideration, is, therefore, respectfully requested.

The Examiner objects to disclosure indicating that a reference label in paragraph 44 of the specification needs a description in Figure 2. The reference L3 needs a description in new Figure 27.

The specification has been amended to provide the necessary reference labels noted by the Examiner.

The Examiner also objects to the disclosure for the following reasons:

1) In the description of the circuits depicted in Figures 1, 2, 3, 10, 13, 14, 15 21 (Figure 10 appears to be an error and Applicant will address it as if it were Figure 11), all reference labels which are unique to a particular drawing figure should have a corresponding description in the specification, and

2) The graphs depicted in Figures 4,5, 6, 8, 10, 12, 16, 17, 18, 20, 23, 24, 25 require further elaboration of important aspects or features depicted by the curves in the respective graphs.

Both grounds of disclosure have been addressed by the amendments to the specification which conform the specification to all of the unique reference labels in each Figure. The specification has also been amended ,without adding new subject matter, to briefly elaborate on the important aspects or features depicted by the curves in the respective graphs.

For these reasons, it is respectfully submitted that all objections to the disclosure have been overcome.

The replacement drawings are objected to since certain of the drawing figures are considered to be of poor quality. The Examiner also notes that Figure 13 requires additional reference labels.

A substitute set of replacement drawings are submitted herewith in which the reference labels in Figures 1, 2 and 13 have been amended to provide conformity with the specification. The replacement drawings are submitted to be of a clear and good quality.

For these reasons, it is respectfully submitted that the objections to the drawings have been overcome.

Claim 54 is rejected under 35 USC § 112, second paragraph. Claim 52 has been amended as set forth herein to provide antecedent basis for the term "the series impedance" in claim 34. Thus, it is submitted that the rejection of claim 54 has been overcome.

Claims 52-57 are rejected under 35 USC § 103(a) as being unpatentable over Kirino in view of Mantele.

The Examiner contends that Kirino teaches most of the features of Applicants' claimed invention except that Kirino does not explicitly disclose first series tunable elements and second tunable elements parallel connected to a respective antenna.

The Examiner cites Mantele for disclosing a phase shifter comprising a transmission line defined by serially align distributed inductors and parallel connected varactors. The Examiner contends that the transmission of Mantele is considered "tunable" by virtue of being designed to a different inductive reactance and where the varactors are considered "tunable" by the application of a control voltage to change the capacitance of the varactor. The Examiner also contends that the series connected inductors of Mantele would necessarily provide impedance inversion from one end to the other end.

The Examiner concludes that it would have been obvious in view of the references, taken as a whole:

1) To have realized the serious connection of phase shift elements in the phase array antenna of Kirino to be realized by series connected phase shift configuration as taught by Figure 1 of Mantele. Such a modification would have been considered an obvious substitution of art recognized equivalent series connected phase shift configurations, thereby suggesting the obviousness of such a modification.

2) It should be noted that the series connection of plural phase shift elements as taught by Mantele would obviously have been compatible with the series connection of the generic phase shift elements in Kirino, thereby further suggesting the obviousness of such a modification.

3) It should be noted that as an obvious consequence of using the series connected phase shift elements of Mantele, such a combination would have necessarily included the respective varactors being connected in parallel with the corresponding antenna, such as to have been consistent with the teaching of the primary reference (i.e., antennas such as modified by Mantele, i.e., shunt varactors).

4) It should be noted that for the transforming of the admittance to the conjugate impedance at each antenna port, while Kirino does not explicitly disclose such an electrical effect, such an effect, by virtue of the selecting the impedance (and thus the admittance) of the antenna and the impedance matching circuit, those of ordinary skill in the art would have found it obvious to have selected a conjugate admittance as a desirable impedance characteristic, especially since selecting the conjugate admittance would necessarily compensate for the imaginary component of the impedance, thereby leaving the real component of impedance at each antenna port and thus would have resulted in the same magnitude of signal at each antenna port across the circuit.

5) Moreover it is known to those of ordinary skill in the art, the transmission line could alternately be realized by series inductors designed to a desired length (e.g. quarter wavelength corresponding to the desired inductive reactance) as an obvious design consideration.

6) Similarly, by virtue of designing the two inductors to be a quarter wavelength each, the corresponding electrical length of the equivalent transmission line would obviously have been one-half wavelength, thereby providing a half-wavelength distance between adjacent antennas to the series connected phase shift elements.

Mantele shows in Figure 1 a single stage varactor controlled phase shifter device. Kirino discloses a multiple stage phased array antenna. If Mantele is combined with Kirino, as suggested by the Examiner, the terminals 51A, B, and 53 A, B of Mantele would have to be inserted between each stage of Kirino, such as between element 809 and the second matching device 812 as a replacement for the matching device 812, the antenna 804Aand the phase shifter 805A. This replacement would have to be repeated for each stage of Kirino. As

shown in Figure 1 of Mantele, each section of the transmission line includes multiple varactors.

Therefore, to achieve a significant phase shift, a transmission line with significant electrical length is needed. Therefore, many sections would have to be used to achieve a significant phase shift, each containing multiple varactors. (See Inventor Declaration pages 1, ¶1 and page 2, ¶¶ 1 and 2).

Kirino teaches fixed, non-tunable matching circuits (see Inventor Declaration page 2, ¶1, line 2). Thus, Kirino is not able to cope with the variation of line impedance. The characteristic impedance variation and the phase shifter will result in unequal power distribution across Kirino's array if Mantele's phase shifter is combined with Kirino. (See Inventor Declaration, page 2, ¶¶ 2 and 3).

Applicants' extended resonance circuit not only uses a very limited number of tunable impedances, as opposed to tens or hundreds of tunable elements in Mantele, but it also maintains the exact impedance match across the ports. In other words, as the tunable elements are varied in Applicants extended resonance circuit, equal power distribution remains unchanged. Therefore, any tuning change in the capacitance is not a limitation to equal power division and phase shifting.

The Examiner concludes that it would have been obvious in view of Kirino and Mantele, taken as a whole, to have realized the series connection of phase shift elements in the phased array antenna of Kirino by a series connected phase shift configuration as taught by figure 1 of Mantele.

The Examiner contends that such a modification would have been considered an obvious substitution of art recognized equivalence series connected phase shift configurations, thereby suggesting the obviousness of such a modification.

The Examiner further notes that the series of connections of plural phase shift elements as

taught by Mantele would obviously have been compatible with the series connection of the generic phase shift elements of Kirino.

Mantele's phase shifter cannot automatically be combined with Kirino's design because Kirino suggests fixed, non-tunable matching circuits. Thus, the matching circuit of Kirino will not able to cope with variation of line impedance. Hence, characteristic impedance variations and a phase shift will result in unequal power distribution across Kirino's array when combined with Mantele as posed by the Examiner. (See Inventor Declaration, page 2, ¶1).

The non-equivalence of Mantele and Kirino is further demonstrated by the fact that if an identical phase shift design is desired throughout Kirino's array, the antennas and/or matching network would have to be designed separately for each stage. (See Inventor Declaration page 2, ¶1). Applicants' extended resonance circuit uses the same antenna design with matching networks specifically designed for each stage of the array.

Kirino's phased array cannot use the same antenna design, the same phase shifter design, and a same matching network throughout. At least one of these three elements would have to be designed separately for each section of the phased array. (See Inventor Declaration, page 2 ¶ 4)

On the contrary, Applicants' extended resonance network uses the same antenna design with no matching network which provides a design that can be scaled to any size array.

The Examiner acknowledges that Kirino (and Mantele by inference) are completely devoid of any recognition of use of the conjugate admittance as part of the phase shift and power division for each antenna cell or port. While one skilled in the art of electrical circuit design would necessarily know that admittance is the inverse of impedance, the references are silent of any teaching or suggestion of how one of ordinary skill in the art, in the absence of Applicants' invention, would choose an impedance between each port which transforms the admittance of one port and all downstream ports to its conjugate. The prior art lacks any use of conjugate admittance in a phased antenna array.

The Examiner contends that one of ordinary skill in the art would select the conjugate admittance to compensate for the imaginary component of the impedance thereby leaving the real component of impedance at each antenna port is clearly a result of the hindsight reconstruction using Applicants' invention as a basis for reaching such a conclusion.

The Examiner may be confusing conjugate admittance with conjugate matching in circuit design, (see Inventor Declaration, page 3, ¶6). The transformation of impedance to its conjugate has nothing to do with the practice of conjugate admittance in an extended resonance circuit. Applicants are not matching their circuit until the very last element in the element in the chain. Impedance matching requires that the impedance of the load should be the conjugate of the impedance of the source. However, this impedance matching has nothing to do with Applicants' circuit.

Regarding the significant electrical length of the transmission line and the hundreds of tuning elements required resulting from the combination, the Examiner contends that such arguments would not be commensurate with what is positively claimed (i.e. the claims include no explicit limitation as to the line length or the number of tunable elements required) and regarding the inability of Kirino to cope with impedance variation, such appears to be an unsupported assertion (i.e. applicants' have not provided any further documentation to buttress such an assertion).

Applicant has submitted new claims 58-60 which specify that each series impedance and each shunt impedance comprises a single impedance and that the impedances are identical for each port in the phased array. Thus, it is submitted that the new claims 58-60 clearly define the features of Applicant's invention in a patentable manner over the cited references.

Regarding the inability of Kirino, to cope with variation in line impedance thereby rendering the combination as being inappropriate, the examiner reiterates the unsupported nature of such an assertion and regarding the assertion that the antenna & matching networks must be separately designed for each stage, such an assertion is not commensurate with what is actually claimed (i.e. the claims do not positively require the same design for each section of the circuit).

For this rejection, the Examiner's attention is directed to attached Inventor's Declaration, specifically page 2, ¶1; and page 2, ¶4, and new claims 58-60.

Regarding the lack of teaching or suggestion for transforming of the admittance to the conjugate admittance at each antenna port as set forth in the above rejection, while Kirino does not explicitly disclose such an electrical effect, the examine reiterates that by virtue of

the selecting the impedance (and thus the admittance) of the antenna and the impedance matching circuit, those of ordinary skill in the art would have found it obvious to have selected a conjugate admittance as a desirable impedance characteristic, especially since selecting the conjugate admittance would necessarily compensate for the imaginary component of the impedance, thereby leaving the real component of impedance at each antenna port to provide for the constant magnitude of signal across the circuit. It should be noted that in this rejection, the examined has gleaned the reason or rationale for applying the conjugate admittance from common knowledge in the art and thus has not engage in impermissible hindsight reconstruction (i.e. the examined has not gleaned this teaching/suggestion solely from applicants' disclosure). Furthermore in light of the recognition of the conjugate admittance and the manner in which it was applied, there is no confusion on the examiners part as to how this concept was applied in the above combination.

The Examiner's attention is directed to the Inventor's Declaration on page 2, ¶3 and page 3, ¶¶ 5 and 6.which clearly identifies the function and use of conjugate admittance in Applicants' phased array. The Examiner's reasoning regarding conjugate admittance is correct only insofar that one of ordinary skill in the art of electrical engineering should know what conjugate admittance is. However, such knowledge does not imbue one of ordinary skill in the art with the knowledge or insight of how to apply conjugate admittance for each port in a phased array to assist in creating equal power division and phase shifting across the array as done by the Applicants in the present invention.

* Thus, the Examiner's basis for this rejection is submitted to be in error.

In conclusion, for the reasons set forth above, taken in combination with the amendments to the claims and specification, it is respectfully submitted that all objections and rejections have been overcome. Accordingly, claims 52-60 are submitted to be in condition for allowance; a notice of which is respectfully requested.

Respectfully submitted,

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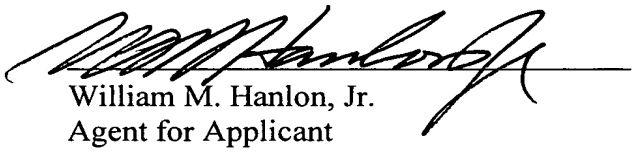

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